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ABSTRACT

Contained in this newsletter are several articles pertaining to activities of the Engineering Concepts Curriculum Project at the Polytechnic Institute of Brooklyn, New York. Two are of major concern. One deals with the development of a laboratory science course for senior high school students to improve technological literacy and entitled "The Man Made World." Designed to familiarize students with certain concepts which pervade modern technology (its capabilities, characteristics, and limitations) the course emphasizes information systems science and engineering. The ECCP approach is to work from an actual problem to the solution framework and then to the concepts. Course content, laboratory work, and behavioral objectives are described. The second article discusses science-society issues and secondary school teachers; what is the role of secondary schools in the matching of men and technology, and how can secondary school teachers be prepared? Two issues, control of the noise environment and automated health examinations, are presented for examples. Regarding teacher preparation, five possibilities on how today's programs might evolve gradually into an educational program more directly related to these issues are explored. (BL)

The Man Made World

ECCP Newsletter

ENGINEERING CONCEPTS CURRICULUM PROJECT

VOLUME IV, NO. 2

SEPT.-OCT., 1970

NIXON NAMES E. E. DAVID, JR., AS NEW SCIENCE ADVISOR

President Nixon has appointed Dr. E. E. David, Jr., former co-director of ECCP as his science advisor to succeed Dr. L. A. Dubridge, former president of the California Institute of Technology. Dr. David, one of the founders of *The Man-Made World* course, is being asked by the Nixon administration to concentrate on finding ways to apply scientific research to human needs.

White House sources said this signals a shift in emphasis away from basic research and space exploration toward health, environment, and other human needs. To oversimplify it, Nixon would rather have a cure for cancer than an American on Mars. David said the President told him that his main objective should be to use science "for the benefit of people."

Dr. David and many of his colleagues at Bell Labs have made major contributions to the ECCP course especially in the area of digital computers. At Bell Labs, he is responsible for the Electronics Systems Research Laboratory, the Computing Science Research Center, and the Communication Principles Research Laboratory. He is also active in the academic world. As a member of the Council of the National Academy of Engineering, he served as vice chairman for the Academy's Commission on Education. David is a member of the visiting committees for the departments of Electrical Engineering at the Carnegie-Mellon Institute, Princeton University, Georgia Institute of Technology and the University of Rochester. He currently is adjunct professor of electrical engineering at Stevens Institute of Technology.

Dr. David received the B. S. degree in electrical engineering from Georgia Tech. in 1945, and S.M. and Sc.D. degrees from M.I.T. in 1947 and 1950, respectively. He joined Bell Labs in 1950 and worked in underwater sound programs and extensively in acoustics research in communications. This latter work was reflected in his co-authorship of two books: "Man's World of Sound" and "Waves and the Ear." Since 1963, he has specialized in computing science research, doing work in advanced computing techniques with particular emphasis on man-machine communications. In 1964, the ECCP course was started under the leadership of Dr. David. His philosophy of using science and technology for the benefit of mankind pervades the ECCP course.

Besides being Nixon's science advisor, Dr. David will also serve as the director of the Office of Science and Technology and be in charge of staff operations in the field of science and technology in the executive office of the President.

We at ECCP headquarters who have worked with Dr. David for the last five years know of his insight in the proper match between technology and people. We are naturally very proud of his appointment and know he will be a great asset to the Nixon administration as it tries to make more intelligent use of our scientific and technological resources.

T. Liao

TOWARD TECHNOLOGICAL LITERACY

Is technological change good, evil, or overrated? For some time, the debate over the technological revolution has been conducted among those who passionately affirm its benefits, those who point to its disadvantages and appalling cost, and those who maintain that it has had relatively little effect on basic patterns of life on Earth.

The truth, however, is far more complex than any of these points of view. Technological change is occurring more rapidly and its impact on man and society has both positive and negative aspects. In talking about the impact of machine civilization, Harrison Brown has said:

"Whether or not man survives depends upon whether or not man is able to recognize the problems that have been created, anticipate the problems that will confront him in the future and devise solutions that can be embraced by society as a whole."

Survival of our civilization and each of us as individuals does indeed depend upon our ability to adapt to technological developments and to control the changes that they produce within our society. An understanding of advances being made now and those under development for the future must be made accessible to all groups and strata. Within the democratic process, proper control of technology can be realized only with public understanding of the nature, the capabilities, the limitations, and the trends of technology. The health of a society, its cities, and its social institutions depends on its ability to adapt to modern technology and to control the development of that technology for the benefit of man. Thus, it is essential that the public be helped toward "technological literacy."

Currently there are 300 high schools across the nation where technological literacy is being developed. The understanding of the impact of technology on today's society comes through a new course called *The Man-Made World* which seeks to deal with relevant problems in today's technological society. The course, does not offer pat solutions to such problems, but tries to develop a way of considering them, and an understanding for solving them.

What is *The Man-Made World*

The Man-Made World is a laboratory science course for students in the last two years of high school. Requiring only one year of high school algebra as a prerequisite, the course was developed to give a student an understanding of modern technology (its capabilities, characteristics, and limitations) which is so important if he is to cope with the world in an age of technology. Because of these broad objectives, the course emphasizes information systems science and engineering.

It is not an engineering course, even though it was developed under the Engineering Concepts Curriculum Project (ECCP), headquartered at Polytechnic Institute of Brooklyn. It is not designed primarily for future majors in science or engineering, nor was it developed to proselytize students into engineering careers. Rather it is designed to familiarize students with certain concepts which pervade modern technology.

The course evolved from a conviction that the world (and the United States initially) has moved into an age of technology – a period when unlimited technological accomplishments are possible. If humans are to develop this technology for the benefit of mankind, fundamental national decisions must be made. The question is no longer what man can accomplish; it is now what men should choose as national goals. If such decisions are to govern the evolution of a free society, they must be made with the population possessing at least a minimal appreciation and understanding.

Course Content

Content of *The Man-Made World* has undergone changes during the five years of the Project. The goal remained the same: to bring engineering concepts to the non-science-oriented high school student.

Concepts first selected were those underlying the information systems (modern communications, control, computers, and man-machine interaction). These were considered the foundation for the modern "age of technology" – for example developments in communication, urban system studies, automation, biomedical engineering and the delivery of health services.

In its early approach, the course was typical of science offerings, with an emphasis on teaching the student irrefutable concepts and techniques. It was soon discovered students and teachers were most enthusiastic about the occasional, brief discussions of the human and social implications of the technological concepts.

The preliminary paperback text, published in 1968, represented a marked change from earlier, informal material. For example, the two early chapters on decision theory included consideration of the problems of routing police patrol cars to cover a precinct, of routing ambulances or fire engines to reach a destination in minimum time, and queue formation in supermarkets or at airports. Teachers' experiences demonstrated forcefully the importance of this emphasis.

Consequently, the 1969-70 revision of the text has left unchanged the engineering concepts, but brings major emphasis to the interpretation of these concepts in terms of today's social systems. For example, the two chapters on decision-making now omit purely technological problems (such as linear programming in industrial production). Instead, there is discussion of such topics as:

(1) Decision problems in which there is no apparent solution – e.g., the urban housing crisis created by current economic conditions, and the resulting abandonment of buildings.

(2) Techniques for reducing queue lengths in familiar situations, and then the possible desirability of bottlenecks with reasonable queues.

Furthermore, strong consideration is given man's limitations, and the use of technology to overcome or circumvent these. These discussions range from the familiar relationship between human response time and the duration of the yellow phase of a traffic light, to the problems of matching machines to men.

One basic approach has remained unchanged. Early in the project the decision was made to work from an actual problem to the solution framework and then to the concepts. This is in strong contrast to much of science teaching, where the conceptual material is presented first, often in abstract terms, and one works through the hierarchy of learning toward the goal of an illustrative application. The ECCP approach has proven particularly appropriate, coupled with its emphasis on social and human problems.

As reported in the summer Newsletter, the regular (hard-cover) edition of *The Man-Made World* text is due to be published in January, 1971. It will be divided in 15 chapters with 60 laboratory and classroom projects which are incorporated in the textbook. The titles of the chapters are as follows:

Chapter	Title
1	Technology and Man
2	Decision Making
3	Optimization
4	Modeling
5	Systems
6	Patterns of Change
7	Feedback
8	Stability
9	Machines and Systems for Men
10	The Thinking Man's Machine
11	Communicating to Computers
12	Logical Thought and Logic Circuits
13	Logic Circuits as Building Blocks
14	Machine Memory.
15	A Minimicro Computer

Laboratory Work

The Project has long devoted a major portion of its resources (in men and money) to develop laboratory, experimental work which would strongly complement the text, involve inexpensive equipment which is reliable, and motivate students through its obvious relevance. Unfortunately, the requirements are not always compatible.

Major devices to the Project are the analog computer, the logic circuit board, and the CARDIAC (a CARDboard Illustrative Aid to Computation). In addition, manuals list a variety of smaller items.

Through major efforts in cost reduction and equipment simplification, a school can now offer the full course with a minimal expenditure of $1,500 for a class of 24 students, although $3,000 permits more flexibility in laboratory operation. None of the equipment is expendable, so the cost is nonrecurring.

The contribution of industrial organizations has been notable. The CARDIAC, developed at Bell Laboratories, is now available as a Bell System Educational Aid. Staff members from Bell Labs consistently played a vital role in lab development. American Machine and Foundry Co., manufacturing the analog computer and logic circuit board, has made major contributions in development work. Philadelphia Scientific Controls, making available the signal generator and oscilloscope, is the third organization actively assisting.

During the past year and a half, major emphasis has been placed on laboratory or project experiments which relate to the emerging social science orientation of the course and which simultaneously require no special equipment. The "Future" game developed by the Project, a glowing success in many schools, will be incorporated in the text. Several modeling problems, familiar to the students, have been developed (water pollution control, and duration of the yellow traffic light, for example).

Behavioral Objectives

There is much talk in educational circles that only measurable behavioral objectives are valid and that those who would develop curricula must eschew all others. While there is no question about the value of aiming a course or a school system in the general direction of behavioral changes, there are many other subtle immeasurable changes which take place in a person during the process which we call education. To rule out these changes or attempts to bring them about simply because it is not always possible to measure them would reduce our educational endeavors mainly to the level of skill development. Any list of objectives is useful only if the teacher understands them, has some ideas on how to meet them, and is familiar with some attempts to measure student achievement of them.

The following statements describe the major objectives of *The Man-Made World* course. Some are stated in behavioral terms and some are not. The overriding objective of the project is to develop technological literacy. Other concerns are that students understand that there is constant interaction among science, technology, and society; that any major decisions or changes in one must affect the other two.

What are some of the characteristics of a technologically literate person?

1) He can use the decision-making process effectively.

2) He can make valid predictions from models.

3) He can use models to simulate real situations.

4) He can use optimization techniques in making real world decisions as well as in classroom situations.

5) He can demonstrate how feedback is used to control social, political, economic, ecological, biological, mechanical, and technological systems.

6) He can predict from models when a system might become unstable.

7) He can communicate with machines so that he uses the machine effectively.

8) He is familiar enough with logic and logic circuits to understand that complex computers are made from simple circuits.

9) He is willing to use the tools of technology to attempt solutions to real problems.

10) He is willing to look for more than one answer to complex problems.

11) He probes for causal relationships between science technology and society.

12) He questions the possible effects of technological "improvements" on the environment.

13) He weighs the relative merits and risks of new products and processes.

14) He recognizes that the development of criteria and stating of constraints are subjective activities.

15) He recognizes that technology will create entirely new possibilities for society. As a result the world will be a different place to live in in the future, and that only knowledge of both technology and humanity can insure that it will be a better place to live in.

There are other objectives which are subsets of these and which are stated at the beginning to chapters in the Teacher's Manual. Suggestions on how to work with students toward the attainment of these objectives make up the major portion of the Teacher's Manual. Suggestions and instruments for measuring student accomplishment make up the evaluation section of the Teacher's Manual.

Conclusion

Thus, the Engineering Concepts Curriculum Project at P.I.B. now has completed a five-year program to investigate whether modern information technology, and the interaction of technology with society and the environment, could provide a vehicle for a high school course which would:

(1) Be of interest to the majority of the students not planning careers in science and engineering.

(2) Be attractive to teachers and school administrators.

(3) Develop reasonable technological literacy among the students – particularly an understanding of that technology which will interface with their lives.

The growth of enrollment in the schools offering the course more than one year provides the strongest affirmative answer to 1 and 3. As of the spring of 1970, no school which has introduced the course has dropped it (except for the few where the trained teachers have left).

Question 2 is more difficult. Both teachers and administrators have been remarkably enthusiastic. The fact that the course does not fit easily into normal high school departments makes introduction of the course often difficult. As the emphasis on social science interrelationships increases, the course moves more and more toward the frequently expressed desire for a multidisciplinary offering, but also encounters more difficulty in the school with conservative curriculum planning.

Does the course have a significant impact on the educational experience of the student? Thus far, the ECCP can respond only with the enthusiastic testimony from students and teachers, and the numerous indications of student accomplishments (e.g., in project work). As with technology itself, it has proven that man can solve the problem. It hopes to show now that, given the solution, man can supply the energy, volition, and funds to make this educational experience available on an even broader basis.

T. Liao, E. J. Piel

SCIENCE-SOCIETY ISSUES AND SECONDARY SCHOOL TEACHERS

Engineers writing on the topic of science-society issues face certain immediate difficulties. Certainly engineering (that is, the human use of science) has played a significant role in creating our forthcoming "age of technology" with which we can associate some of the major problems now confronting American society. To place total (or even major) blame on the engineer, however, is analogous to blaming the farmer for the obesity of so many middle-aged Americans. By producing plentiful supplies of inexpensive food, the farmer has played this role, but we can hardly expect the farmer to adjust his productivity to counteract social and human weaknesses. Yet some of our most vocal, neo-Luddites seem determined to place exactly similar responsibilities on the scientist and engineer.

If we adopt a saner approach, we should ask: what are the truly lasting, science-society issues? In resolving these issues, what contributions can be made by technology? In what areas can modern technology provide meaningful improvements, or more time in which to seek fundamental changes in social and human behavioral patterns? Finally, we ask: what is the role of secondary schools in this matching of men and technology, and how can secondary school teachers be prepared?

The Issues

The issues with which we are concerned center on the matching of technology to man and his society. New technology must be developed and then used to allow the continued transition into the age of technology without ...us effects on man, his social organizations, and his ...onment.

A specific example illustrates the challenge and the problems. Noise in an urban community is steadily increasing as a consequence of greater use of air conditioners, more vehicular traffic, construction of skyscrapers, widespread use of record and tape players, greater aircraft density, development of mass transit systems, and so on. Recent scientific research suggests that the familiar deterioration of hearing with age may be the result of the sound environment, and that this hearing loss is worsening. Indeed, there have even been predictions that deafness will be a major affliction in New York City by the year 2000. Even more alarming is the lack of knowledge about the dependence of mental ill health and stability on the noise environment, or the effects of sleep during noise on general physical health.

Relatively simple measurements of noise do suggest that certain locations in New York City (for example) are clearly dangerous. The noise level in a subway station with an approaching train approximates that at an airport where workers are required to wear ear protection. Yet there is no legal protection for the frequent subway rider.

If one accepts as legitimate the worry about the noise environment, the next question is what can be done? Improvement depends primarily on political action, which in turn depends on public understanding of the issues. Noise abatement procedures require either changes in the pattern of human behavior or the expenditure of funds to protect the public Achieving the former is usually a long-term possibility only; effecting the latter requires public education.

A second example of a major current issue is provided by the much-publicized U. S. health picture. The last two federal administrations have both emphasized the relatively sorry state of American health. With almost twice as many visits to doctors per person per year as Sweden, we still have almost 40% of our population which is tragically separated from the health care system – particularly those people in the central city. One result is the poor U. S. ranking in life expectancy and infant mortality.

A significant hope for improvement rests in the automated health testing center, buildings located in each neighborhood of a city or mobile units visiting the rural population. Such centers, giving highly instrumented and automated health examinations, can detect diseases which can be arrested or cured if caught early – a form of human preventive maintenance. The centers hold the promise of utilizing the physician more effectively and of reducing hospitalization (with its rapidly growing costs).

The potential impact of such centers also points out a primary danger. As usual with most technology, it is much simpler to use the system in middle-class suburbs than in the central city (where people tend to be unfamiliar with health care, often distrust technological devices, and frequently find communication difficult because of language problems). Consequently, if the development of such centers is allowed to proceed without social or governmental constraints, the major effect by 1980 is likely to be even better health care for the suburbanites – an even greater chasm between suburbia and the central city. This need for political control over the development of technology is the origin of Congressman Daddario's call for "technology assessment."

These two examples (control of the noise environment and automated health examinations) emphasize the need for education of the public in the basic characteristics of the modern technology-society interface. Many other examples can be cited. Modern traffic control systems will not work without the understanding cooperation of the public. In state after state, the voters are being asked to decide issues with major technological content, but they have an educational background which does not include any of the concepts which underlie information systems science (decision-making, modelling, management science, operations research, communications, and computer science).

Teacher Preparation

If the above, very brief and superficial discussion does define some of the major science-society issues of the 1970's, what is the significance in the preparation of secondary school teachers? How might today's programs evolve gradually into an educational program more directly related to these issues? Several possibilities seem particularly promising.

(1) The first emphasis one observes throughout the issues is that on quantification. Problems are studied in terms of *quantitative* models, as a prelude to logical thinking and decision making. While we often hear that mathematics is the future language of educated men in most disciplines, we refer here not to advanced mathematics, but rather to such fundamental models as graphs (in many forms) and the simplest ideas of probability.

For example, the current interest in ZPG (zero population growth) really has to be interpreted in terms of the time delay inherent in population changes. The number of women of child-bearing age is already determined for the next 20 years or more. Significant population-trend changes can only be accomplished over a relatively long span of time. Thus, if we are worried about the U. S. population to the year 2000, we are already in a position to make reasonably good predictions; if we are concerned about the productive, working population in 2000, this is already largely determined. Students cannot discuss population problems intelligently without an understanding of such delays (or the corresponding algebraic, difference equations) and a familiarity with at least the properties of exponentials.

If our future graduates are to think in terms of such quantitative models, many of the courses now taught at the undergraduate level must be brought in tune with recent trends in those fields. Research in the social and behavioral sciences emphasizes such models. The influence of the economist in Washington during the past decade stems from his success with such models. Resource management in biology has been altered by the use of computer models. All too often our undergraduate course work (and we include here the engineering colleges) tends to speak in qualitative and literal terms only.

(2) Much of today's decision and information technology is based on *algorithms* for problem solving. An algorithm is simply a step-by-step procedure to move from the given data to the solution of a problem. For example, to find the largest of three members, we compare the first two, discard the smaller, compare the larger with the third and again discard the smaller.

Traffic control on an urban expressway is accomplished with algorithms based on observation of past flow patterns. Municipal planning is in large measure an attempt to [illegible]op algorithms based on compromise among conflicting [illegible]es and pressures. Almost all practical optimization procedures are algorithmic. Indeed, the computer provides us with a primary tool for implementing algorithms.

In contrast, it seems very little of our educational process emphasizes the importance of algorithms. Instead, in mathematics and science courses, we normally restrict consideration to those few problems which can be solved formally.

(3) Both above items lead naturally to the consideration of computers. While the impact of computers in secondary education is still difficult to foresee, the impact on the lives of our citizens by 1980 can be envisioned. Not only will computers be used for job and apartment hunting, but also computer utilities will furnish computing capability in the many homes where cable television provides 20-channel communication facilities. Computers will also control traffic and transit in the urban areas, will have moved us appreciably toward the cashless society, and will provide a wide variety of home entertainment and games.

In the early 1950's the startling prediction was made that by 1970 there would be *several hundred* computers in the U.S. Now that 1970 has arrived, there are 100,000 computers in use. Automation is widespread, and many businesses could not survive in their present form without automation. (For example, there are not enough people in New York City to perform the detailed functions of non-automated banks). In the same city, more than one of every eight people are on welfare; the fraction of the population in a working role steadily drops; service industries already employ more than production industries, finally, during the next decade, more than a million computer scientists must be added to program, operate, and service this one machine.

In the light of this impending revolution, formal education will certainly include required courses in computer science, initially in the secondary schools. Teachers will then learn rapidly that an understanding of the capabilities and limitations of computers, as well as modest programming experience, is essential knowledge if they are to capitalize on the students' motivation and capability. In view of the rapidity of technological change and the clear signs of the future of computers, the outside observer of the educational scene can not help but be amazed that secondary education programs still may not include required computer experience.

(4) Science courses particularly seem to demand change. The classical introductory courses in physics, chemistry, and biology are still universally designed as a first coverage for prospective majors in the field – not for future social science or science teachers who will be in close contact with a young generation impatient with the classical irrelevance. This, incidentally, is precisely the same problem the engineering student has faced in college, where the science and mathematics courses are normally those offered to their own majors.

The biology course can be used as an example. The exciting parts of modern biology (for the future teacher) are resource management, genetics, and human behavior. It is easy to visualize a dynamic year course covering just these three areas – the problems of lampreys in the Great Lakes or the salmon population of the northwest; the double-helix history and the basic ideas of molecular biology; and the characteristics of human senses, the formation of speech, and the operation of human homeostatic systems. Such a course would omit the detailed discussion of all types of insects and the familiarization with 1500 specialized vocabulary items, but what an opportunity for exciting experiments and projects!

(5) Finally, the educational program should contain some discussion of those concepts which underlie the world of modern technology – concepts such as dynamic behavior or feedback in the systems area, or the ideas which permit the fabrication of plastics and synthetics in the realm of materials. These are the concepts which distinguish modern applied science and engineering from the classical fields, the concepts which change our national emphasis from "what can we do" to "what should we do".

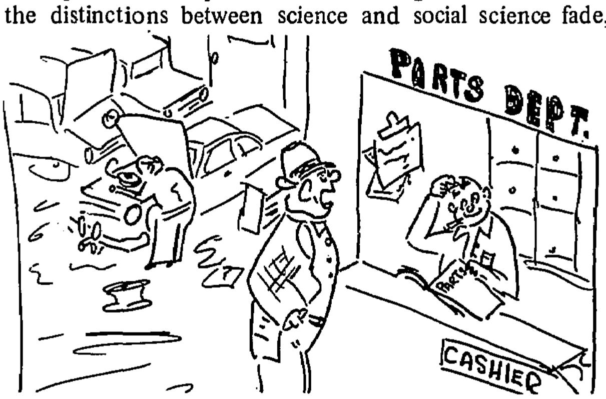
For instance, *stability* is one of these concepts. When is a system unstable? What characteristics are associated with possible instability? What determines when an epidemic will occur, how rapidly that epidemic will spread, and what fraction of the population will ultimately be affected? Once the epidemic behavior is discovered, we can undertake measures to control its spread. Very similar models describe the spread of rumors through a community, or the utilization of propaganda by a governmental system. Stability phenomena are also important in traffic flow, where average speed falls rapidly when traffic density exceeds the limit of stability. The air traffic control system near many major airports continually operates close to instability, as bad weather clearly emphasizes and the flight controllers have dramatized.

Concluding Comments

The science-society interface poses fundamental problems if we are to survive as a society and if we are to survive as individuals. As a society, we must find logical decision mechanisms to develop and use technology in a way to preserve fundamental values and to protect essential institutions. As individuals, we must be able to adapt our behavior to technological change, and we must understand the operation of the technological systems we encounter, in both cases sufficiently to ensure that the new technology does enrich life.

Success in both "survival" endeavors requires an educational system in which the science education is concerned with understanding of both the natural and the man-made worlds. In parallel, education in the humanities must look not only backward to the past, but also forward to the cultural and aesthetic values and problems of the present and future. As we find more and more unifying, intellectual concepts and basic problems which bridge the two cultures, the distinctions between science and social science fade, and between the sciences and humanities lessen in importance. In this era of decreased departmentalization, the secondary science teacher must be familiar with those concepts which are providing this unification of knowledge and understanding.

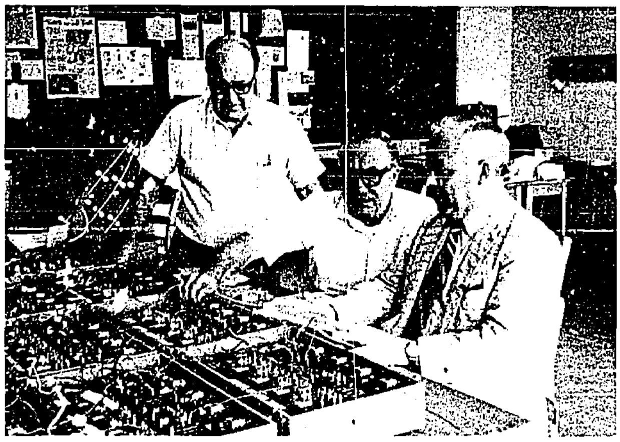
L. Braun, E. J. Piel, J. G. Truxal



"If this is such a technological society how come it's ier to get a spare part for a 1915 human being n a 1966 car?"

UNIVERSITY OF WISCONSIN

Jim McNeary reports that their summer institute ended with a bang! This was due to the fact that the participants at the University of Wisconsin actually worked together to build Jim's brainchild, the Minimicro computer. In Jim's words, "This worked wonders for the close of our institute – everyone was in on the act." Any ECCP teacher who would like to obtain a copy of the instructions for putting eight logic boards together to build the minimicro computer should write project headquarters.



From right to left: Jim McNeary, Ed Anderson and Summer Inst. participant

Participants in Workshop

BROOKLYN POLY AT FARMINGDALE

The participants of the summer institute at Brooklyn Poly's graduate center had the rare treat of listening to Dr. E. E. David, Jr., newly appointed science advisor to President Nixon, speak on the topic, artificial speech. This occurred about two weeks before Nixon's announcement of David's appointment. The summer institute was also attended by three science educators from Cairo, Egypt, Doctors Soliman and Assad and Mr. Morely. Their participation was made possible by The American University in Cairo.

LEARNING VIA CASSETTES

As an extension of the project laboratory development activity, a Tape/Workbook has been prepared to serve as an Introduction to the Analog Computer. Consisting of a 90 minute tape cassette and a 37 page workbook, the combination, together with the analog computer, is designed for individual student use. No preparation other than the ability to use a cassette tape recorder is expected. The program covers the four basic functions of the computer, namely addition, subtraction, scaling and integration. The workbook consists principally of figures and graphs with interspersed question sets. The tape is designed to involve maximum student-computer interaction. Students wire up illustrative examples to help develop an understanding of the full range of capability of the computer. The time required to work through the program varies widely according to student ability and background. A minimum time seems to be about two and one-half hours.

These Tape/Workbooks were used by individual teachers at several of the ECCP summer workshops and the many helpful suggestions so generated have been incorporated into the latest version of the learning aid.

As the trend toward individualized and modularized instruction increases, and since an ability to use the analog computer is a basic requirement for a large fraction of the ECCP laboratory experiments, the availability of an instructional aid that could provide a student with that basic skill at his best learning pace is considered an important addition to the ECCP instructional package.

A limited number of Tape/Workbooks are available on loan from the ECCP project office. A three-week loan would cost only return postage. However, an evaluation sheet will be sent with each Tape/Workbook and a completed evaluation would be expected as a condition of the loan. Copies of the Tape/Workbook are also available for sale at $6.00 each. Orders should be placed with the project office at Polytechnic Institute of Brooklyn.

D. C. Miller

SUMMER HAPPENINGS

This past summer about 250 secondary teachers were trained to teach *The Man-Made World* course at six summer institutes and four CCSS institutes. Approximately a hundred of these newly trained teachers have already started teaching the course. Many of the others are planning on starting the course in September 1971. As editor of the Newsletter, I would like to welcome you all to the ECCP group and look forward to hearing from you. I would also like to encourage the experienced ECCP teachers to write. Remember – the Newsletter is a means for all of you to share information.

AMF ANNOUNCES PRICE CHANGES

American Machine and Foundry Company has announced that there will be price changes on four of the ECCP laboratory devices. The following price increases will be in effect as of January 1, 1971:

	Old Price	New Price
Logic Circuit Board	$70	$75
LCB Switch Demo	4	6
Torque Amplifier	42	50
Theodolite	6	9

LABORATORY DEMONSTRATION ANALOG COMPUTER

As noted in the last issue of the Newsletter, a major addition to the ECCP laboratory package is the Model 775 Demonstration Analog Computer. As some schools start the ECCP program with only one analog computer because of budget limitations, the provision of a unit designed for demonstration use in the classroom was considered essential. Even in schools having a number of the student model computers, the visibility of the Demonstration unit panel greatly simplifies class instruction.

The Demonstration computer is shown in the picture below. The panel layout is an enlarged version of the student computer panel with only a few small differences. The background is white and the circuit connections are black to give optimum visibility. Two knobs are provided for the variable outputs of the power supply. The plus and minus voltage outputs can be independently varied thereby providing an additional independent voltage output. Finally, the Remote Operation connection has been eliminated since it seems unlikely that the Demonstration unit will be used with another computer.

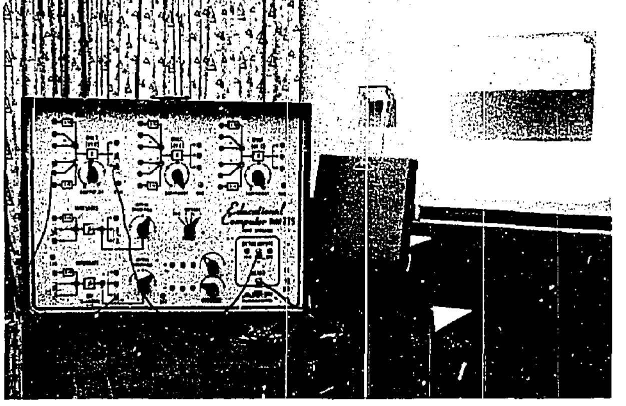
The timer used on the Demonstration unit is the same as is used on the Model C student unit, having three time intervals as well as the manual or continuous integrator position.

A projection meter is provided at no extra cost as a part of the Demonstration computer. As can be seen in the picture, this meter, used with an overhead projector, provides an easily visible output that is identical with the meter scales used in the student model computer. The meter connects to the Demonstration unit by a special cable and receptable so that there is no need to run a separate COMMON lead to the meter. However, the meter can be easily disconnected from cable if other output devices such as an oscilloscope or chart recorder are to be used.

Storage space is provided in a compartment in the base of the unit, accessible from the back. All leads and the meter can be carried in this space. A handle is also provided to simplify transport of the unit.

These Demonstration units were available for use at all the ECCP summer institutes and now a number are in use in the schools. They are available at $430.00 each, from the AMF Alexandria Division, 1025 N. Royal Street, Alexandria, Virginia 22314.

D. C. Miller



Demonstration Model of Analog Computer

TEACHER PROFILE

Ronald Hugo is in his second year of teaching ECCP at Edison High School in Philadelphia. Ron not only taught ECCP to one class of trade preparatory students, but he also gave the course for a group of women from the community and again for the other science teachers in his school.

Ron's teaching abilities have been recognized by the School District of Philadelphia and the American Heart Association. Both of these organizations have given him grants for student research projects, in addition to the American Association of Biology Teachers which recently named Ron the "Outstanding Biology Teacher of the Year" for Pennsylvania.

Although most of his summer was spent working on ECCP material with the Urban Workshop, Ron did manage to escape from ECCP long enough for a week of camping with his family in Massachusetts.

URBAN WORKSHOP

The participants at ECCP urban workshop truly out-did themselves. Over a hundred student activity worksheets were developed, each accompanied by teacher's manual sheets.

The activities described in the worksheets can be used with most high school students. The worksheets themselves, however, have been designed for those high school students who have poor academic backgrounds; i.e., low math and reading ability. Most of the activities are success oriented so that the above-mentioned low achieving students can have a positive educational experience.

These materials will be tried out during the coming school year by a limited number of urban teachers (10 to 15). We are planning to run another workshop next summer, where modification will be made on the existing activities sheets based on teacher and student feedback. New activities and accompanying sheets will also be generated at this time. Teachers who are interested in using these worksheets should write T. Liao at project headquarters.

THE CONTINUING DIALOGUE

"The Continuing Dialogue" is a special 150 page annotated bibliography of books (published mostly in the last three years) concerned with the interaction between the sciences, the humanities, education and society and with the relationships between science, technology and society. Also included are books on philosophy, religion, sociology, and culture in general.
Individual copies may be ordered at $3.00 per copy from The Institute Libraries, Polytechnic Institute of Brooklyn, 333 Jay Street, Brooklyn, New York 11201.

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If you are interested in future newsletters or information concerning this curriculum development project, contact Dr. E. J. Piel at the above address.

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